Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in this application.

1 (currently amended) An optical sensor for monitoring molecular binding interactions said sensor comprising:

A) at least one porous silicon region comprising more than 1,000 pores, each pore having a nominal width and a nominal depth at least 10 times larger than said nominal width with the depth of each pore being approximately equal to the depth of at least most of the other pores in said porous silicon region, said porous silicon region defining a top surface and a bottom surface, said bottom surface being parallel or approximately parallel to said top surface;

B) at least one buffer-sample fluid flow channel located above said at least one porous silicon region providing a fluid flow passage across said porous silicon region;

C) at least one light source for illuminating said at least one porous silicon region;

D) at least one interference monitor adapted to monitor interference patterns caused by interference of light reflected from said top surface with light reflected from said bottom surface of said at least one porous silicon region, said interference monitor comprising a deep well linear photodiode array of pixels each pixel having a photoelectron full well capacity of about 156 million photoelectrons or more and having a frame rate of about one hundred or more frames of interference fringe data per second;

E) a fluid flow control system for producing controlled flow of buffer solutions, ligand containing solution and analyte containing solutions through said at least one fluid flow channel; and

F) a computer processor programmed with a computer program for making molecular binding measurements based on changes in the interference patterns monitored by the at least one interference monitor while analytes bind with and disassociate from ligands attached to surfaces of said pores; said computer program comprising: a special correlation method for calculation of optical path differences from measured interference fringe patterns wherein each measured fringe pattern is correlated to a test fringe pattern.

2 (previously presented) The optical sensor as in claim 1 wherein said at least one porous silicon region is a plurality of porous silicon regions, said at least one buffer-sample fluid flow channel is a plurality of fluid flow channels, said at least one light source is a plurality of light sources and said at least one spectral monitor is a plurality of spectral monitors.

3 (previously presented) The optical sensor as in claim 2 wherein said

plurality of porous silicon regions is at least four porous silicon regions.

4 (previously presented) The optical sensor as in claim 1 wherein said molecular binding measurements are kinetic molecular binding measurements.

5 (previously presented) The optical sensor as in claim 1 wherein said at least one interference monitor is at least one spectrometer.

6 (withdrawn) The optical sensor as in claim 1 wherein said at one interference monitor comprises at least one photo diode array.

7 (previously presented) The optical sensor as in claim 1 wherein said porous silicon region is located on a silicon substrate.

8 (previously presented) The optical sensor as in claim 7 wherein said silicon substrate is p++-type silicon with a <100>crystalline configuration.

9 (previously presented) The optical sensor as in claim 7 wherein said porous silicon region is incorporated into a fluidics cartridge comprising fluid flow channels and a plurality of flow control valves, said fluid flow channels being in flow communication with said at least one buffer-sample fluid flow channel.

10 (previously presented) The optical sensor as in claim 9 wherein said valves are pneumatically operated pinch valves.

11 (previously presented) The optical sensor as in claim 10 wherein said pinch valves are computer controlled.

12 (previously presented) The optical sensor as in claim 1 wherein said nominal widths of said pores are within the range of about 80 to 120 nanometers and said nominal depths of said pores are within a range of about 1000 to 3000 nanometers.

13 (previously presented) The optical sensor as in claim 9 and also comprising a fluidics enclosure in which said fluidics cartridge is removably installed.

14 (previously presented) The optical sensor as in claim 13 and also comprising robotic equipment for injecting ligand containing samples and analyte-containing samples into said fluidics enclosure.

15 (previously presented) The optical sensor as in claim 1 and also comprising sample trays, at least one buffer fluid tank, at least one waste

tank, a sample pump, a buffer pump and pneumatic controls, firmware and software for automated real-time measurement of kinetic binding reactions.

16 (previously presented) The optical sensor as in claim 14 and also comprising sample trays, at least one buffer fluid tank, at least one waste tank, a sample pump, a buffer pump and pneumatic controls, firmware and software for automated real-time measurement of kinetic binding reactions.

17 (previously presented) The optical sensor as in claim 1 wherein said at least one light source comprises a white light source or an approximately white light source.

18 (withdrawn) The optical sensor as in claim 1 wherein said at least one light source comprises a narrowband light source.

19 (withdrawn) The optical sensor as in claim 1 wherein said at least one light source comprises and ultraviolet light source.

20 (withdrawn) The optical sensor as in claim 1 wherein said at least one light source comprises an infrared light source.

21 (previously presented) The optical sensor as in claim 1 wherein said pores comprise carboxylic acid functionalized surfaces.

22 (previously presented) The optical sensor as in claim 21 and also comprised linker molecules attached to said carboxylic acid functionalized surfaces.

23 (previously presented) The optical sensor as in claim 22 wherein said linker molecules comprise PEG molecules.

24 (previously presented) The sensor as in claim 23 wherein most of said PEG molecules comprise four monomers.

25 (previously presented) The sensor as in claim 23 wherein most of said PEG molecules have a total length of about 19.2 Angstroms.

26 (previously presented) The optical sensor as in claim 1 wherein said computer program comprises algorithms for calculating changes in apparent optical path differences based on said changes in said spectral interference patterns.

27 (withdrawn) The optical sensor as in claim 1 wherein said at least one interference monitor comprises a quad cell.

28 (cancelled)

29 (previously presented) The optical sensor as in claim 1 wherein said nominal width of said pores in said porous silicon region is chosen to produce a modulation index for optimizing optical resolution.

30. (previously presented) The optical sensor as in claim 1 wherein said nominal width of said pores in said porous silicon region is chosen to produce a modulation index for optimizing kinetic binding assays.

31 (withdrawn but currently amended) A method for measuring molecular binding interactions utilizing an optical sensor having: a) at least one porous silicon region comprising more than 1,000 pores, each pore having a nominal width and a nominal depth at least 10 times larger than said nominal width with the depth of each pore being approximately equal to the depth of at least most of the other pores in said porous silicon region, said porous silicon region defining a top surface and a bottom surface, said bottom surface being parallel or approximately parallel to said top surface; b) at least one buffer-sample fluid flow channel located above said at least one porous silicon region providing a fluid flow passage across said porous silicon region; c) at least one light source for illuminating said at least one porous silicon region; d) at least one spectral monitor for monitoring light reflected from said top surface and said bottom surface of said at least one porous silicon region; e) a fluid flow control system for producing controlled flow of buffer solutions, ligand containing solution and ~~a nalyte~~ an analyte containing solutions through said at least one fluid flow channel; and f) a computer processor programmed with a computer program for making kinetic binding measurement based on changes in spectral interference patterns monitored by said at least one spectral monitor while analytes bind with and disassociate from ligands attached to surfaces of said pores; said method comprising: A) Immobilizing ligand molecules within said pores; B) Causing a solution containing analyte molecules to flow across said porous silicon region to permit analyte molecules to diffuse close to and become bound at least temporarily by said ligand molecules; C) Illuminating at least a portion of said porous silicon region so as to produce reflections from said bottom surface and said top surface; and D) Monitor changes in spectral patterns produced by light reflected from said top and bottom surfaces in order to obtain information concerning binding reactions between said ligand and said analyte.

32 (withdrawn) The method as in claim 27 and further comprising a step following Step B of causing a buffer solution to flow across said porous silicon region wherein analytes that have become bound to ligands during step B become disassociated from said ligands.

33 (withdrawn) The method as in claim 28 and further comprising the step of monitoring changes in spectral patterns produced by light reflected from said top and bottom surfaces in order to obtain information concerning disassociation reactions between said ligand and said analyte.

34 (withdrawn) The method as in claim 28 and further comprising the steps of: A) acquiring a reference pattern; B) acquiring a spectral interference pattern; C) normalizing said reference pattern and said spectral interference pattern; D) calculating a first derivative of a corresation function using said normalilzed spectral interference pattern and said normalized reference pattern; E) calculating a zero crossing of said first derivative of said correlation function; and F) recording said zero crossing as an optical path difference.

35 (withdrawn) The method as in claim 30 wherein said zero crossing is calculated using a Newton-Raphson method.

36 (withdrawn) The method as of claim 27 wherein a region above and adjacent to said at least one porous silicon region provides a reference optical path length for producing interference effects.

37 (withdrawn) The method as of claim 27 wherein said porous silicon region provides a reference optical path length for producing interference effects.

38 (currently amended) An optical sensor for monitoring molecular binding interactions said sensor comprising:
A) at least one porous silicon region comprising more than 1,000 pores, each pore having a nominal width and a nominal depth at least 10 times larger than said nominal width with the depth of each pore being approximately equal to the depth of at least most of the other pores in said porous silicon region, said porous silicon region defining a top surface and a bottom surface, said bottom surface being parallel or approximately parallel to said top surface;
B) at least one buffer-sample fluid flow channel located above said at least one porous silicon region providing a fluid flow passage across said porous silicon region;
C) at least one light source for illuminating said at least one porous silicon region;
D) at least one interference monitor adapted to monitor interference patterns caused by interference of light reflected from said top surface said bottom surface of said at least one porous silicon region; said interference monitor comprising a deep well linear photodiode array of pixels each pixel having a photoelectron full well capacity of about 156 million photoelectrons or more and having a frame rate of about one hundred or more frames of interference

fringe data per second;
E) a fluid flow control system for producing controlled flow of buffer solutions, ligand containing solution and analyte containing solutions through said at least one fluid flow channel; and
F) a processor means programmed with a computer program for making kinetic molecular binding measurements based on changes in the interference patterns monitored by the at least one interference monitor while analytes bind with and disassociate from ligands attached to surfaces of said pores, said computer program comprising: a special correlation method for calculation of optical path differences from measured interference fringe patterns wherein each measured fringe pattern is correlated to a test fringe pattern.

39 (previously presented) The sensor as in claim 34 wherein said processor means includes a graph forming means for producing a graph of OPD vs time during periods of ligand-analyte association and ligand-analyte disassociation.

40 (previously presented) The sensor as in claim 34 wherein said processor means includes a computer program for determining values of rate constants k_{on} and k_{off}.

41 (currently amended) An optical sensor for monitoring molecular binding interactions said sensor comprising:
A) at least one porous silicon region, said porous silicon region defining a top surface and a bottom surface, said bottom surface being parallel or approximately parallel to said top surface;
B) at least one buffer-sample fluid flow channel located above said at least one porous silicon region providing a fluid flow passage across said porous silicon region;
C) at least one light source for illuminating said at least one porous silicon region;
D) at least one interference monitor adapted to monitor interference patterns caused by interference of light reflected from said top surface with light reflected from said bottom surface of said at least one porous silicon region; said interference monitor comprising a deep well linear photodiode array of pixels each pixel having a photoelectron full well capacity of about 156 million photoelectrons or more and having a frame rate of about one hundred or more frames of interference fringe data per second;
E) a fluid flow control system for producing controlled flow of buffer solutions, ligand containing solution and analyte containing solutions through said at least one fluid flow channel; and
F) a computer processor programmed with a computer program for making molecular binding measurements based on changes in the interference patterns monitored by the at least one interference monitor while analytes bind with and disassociate from ligands attached to surfaces of said pores,

said computer program comprising: a special correlation method for calculation of optical path differences from measured interference fringe patterns wherein each measured fringe pattern is correlated to a test fringe pattern.

42 (currently amended) An optical sensor for monitoring molecular binding interactions said sensor comprising:
A) at least one porous silicon region comprising more than 1,000 pores, each pore having a nominal width and a nominal depth at least 10 times larger than said nominal width with the depth of each pore being approximately equal to the depth of at least most of the other pores in said porous silicon region, said porous silicon region defining a top surface and a bottom surface, said bottom surface being parallel or approximately parallel to said top surface;
B) at least one buffer-sample fluid flow channel located above said at least one porous silicon region providing a fluid flow passage across said porous silicon region;
C) at least one light source for illuminating said at least one porous silicon region;
D) at least one interference monitor adapted to monitor interference patterns caused by interference of_light reflected from said top surface with light reflected from said bottom surface of said at least one porous silicon region; said interference monitor comprising a deep well linear photodiode array of pixels each pixel having a photoelectron full well capacity of about 156 million photoelectrons or more and having a frame rate of about one hundred or more frames of interference fringe data per second;
E) a fluid flow control system for producing controlled flow of buffer solutions, ligand containing solution and analyte containing solutions through said at least one fluid flow channel; and
F) a computer processor programmed with a computer program for making molecular concentration measurements based on changes in interference patterns monitored by at least one interference monitor while analytes bind with and disassociate from ligands attached to surfaces of said pores, said computer program comprising: a special correlation method for calculation of optical path differences from measured interference fringe patterns wherein each measured fringe pattern is correlated to a test fringe pattern..

43 (previously presented) The optical sensor as in claim 1 wherein said at least one porous silicon region is a plurality of porous silicon regions with more than one of said plurality of porous silicon regions having ligands immobilized within them that are different from ligands immobilized in other porous silicon regions.

44 (previously presented) The optical sensor as in claim 1 and further comprising a mass spectrometer.

45 (new) The optical sensor as in Claim 1 wherein said is adapted to produce fringe patterns with signal to noise ratios of about 90,000.

46 (new) The optical sensor as in Claim 1 wherein the test fringe pattern is described by:

$$I_X(X;\lambda) = I_{10}(\lambda)[1 - M\cos(2\pi X / \lambda)]$$

47 (new) The optical sensor as in Claim 46 where X is a varying test optical thickness, using a correlation integral defined by:

$$C(X) = \frac{1}{M}\int_{-\infty}^{\infty} d\lambda [I_T(X;\lambda) - I_{ro}(\lambda)][I_r(\lambda) - I_{ro}(\lambda)]$$

wherein optical path differences are calculated form the correlation integral as the value X corresponding to a peak of C(X) and the value of X is precisely determined by locating a zero crossing of a first derivative of C(X) with respect to X or C'(X).